UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/039,459	11/07/2001	Hariprasad Sreedharamurthy	MEMC 99-1250/2441.1	1061

321 7590 06/20/2007

SENNIGER POWERS
ONE METROPOLITAN SQUARE
16TH FLOOR
ST LOUIS, MO 63102

EXAMINER	
SONG, MATTHEW J	
ART UNIT	**PAPER NUMBER**
1722	

NOTIFICATION DATE	DELIVERY MODE
06/20/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspatents@senniger.com

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

MAILED

JUN 1 9 2007

GROUP 1700

Application Number: 10/039,459
Filing Date: November 07, 2001
Appellant(s): SREEDHARAMURTHY ET AL.

Richard Schuth
For Appellant

SUBSTITUTE EXAMINER'S ANSWER

This is in response to the appeal brief filed 10/28/2005 appealing from the Office action mailed 1/14/2004.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

Holder et al. WO 99/66108 A1, (Dec. 23, 1999), pp 1-25.

5,922,127	Luter et al.	7-1999
5,942,032	Kim et al.	8-1999
5,19,302	Falster et al.	7-1999

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Holder et al (WO 99/66108).

Holder et al discloses an Czochralski apparatus for preparing silicon crystals with reduced metal content, note entire reference, comprising graphite hot zone structures: a heater **16**, susceptor **14**, thermal shield **18**, heat reflectors, pure tubes, insulation and view port channels and a crystal growth chamber **4**. Holder et al also discloses the graphite utilized to construct the hot zone structures is generally at least 99.99% pure graphite with less than about 5 ppm, where the particle generation during high temperature heating decreases as the purity of the graphite increases (pg 7), this is a teaching that purity is a result effective variable. Holder et al also discloses a protective coating of silicon carbide about 75-150 micrometers thick covering the entire surface to grown directly on the graphite components covering the entire surface to maximize protection comprises 99.99% silicon carbide and 0.01% silicon. Holder et al also teaches the silicon carbide coating provided by industry contains about 1 ppm iron (pg 3).

Holder et al discloses a graphite substrate with a concentration of iron no greater than 5 ppm and a silicon carbide coating, thereon. Holder et al does not disclose a substrate with a concentration of iron no greater than $1.5\text{x } 10^{12}$ atoms/cm^3 or an iron concentration of the protective layer is no greater than $1.0\text{x}10^{12}$ atoms/cm^3. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Holder et al by using a substrate with a reduced iron impurity concentration because purifying an old product is held to be

obvious (MPEP 2144.04 VII). Also note, the mere purity of a product, by itself does not render the product unobvious (Ex parte Gray, 10 USPQ2d 1922 (Bd. Pat. App. & Inter. 1989).

Referring to claim 7-8, Holder et al discloses a layer thickness of 75-125 micrometers.

Referring to claim 9, Holder et al discloses covering the entire surface to maximize the effectiveness.

Claims 10 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Holder et al (WO 99/66108) in view of Falster et al (US 5,919,302) and Kim et al (US 5,942,032).

Holder et al discloses all of the limitations of claim 10, as discussed previously, except the structure component reaches at least 950°C for at least about 80 hours and is within 3 cm to about 5 cm of the silicon single crystal or the silicon melt.

In a Czochralski method for forming low defect density silicon, note entire reference, Falster et al teaches a ingot is cooled from a solidification temperature to a temperature in excess of about 1050°C over a period of at least about 75 hours and control of the cooling rate can be achieved by using any means currently known in the art for minimizing heat transfer, including the use of insulators, heaters, radiation shields and magnetic fields (col 9, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Holder et al with Falster et al to form an ingot having an axially symmetric region, which is substantially free of defects (col 3, ln 1-67).

In a single crystal pulling apparatus, note entire reference, Kim et al discloses a lower heat shield **42** is about 50-60 mm above the surface of a the melt in a crucible (col 9, ln 1-67) to prevent heat from radiating from the side walls of the crucible to a ingot except in the space

between the bottom of the lower heat shield and the surface of the melt. Kim et al also discloses an upper heat shield **36**, an intermediate heat shield **40** and vertically arranged heating panels **24**, where the heating panel which heats the interior of the crystal puller reads on applicant's upper heater, composed of graphite and the intermediate heat shield supports the upper heat shield (col 6, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Holder et al and Falster et al with Kim et al to inhibit agglomeration of defects in the crystal growth process (col 3, ln 1-67).

Claims 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Holder et al (WO 99/66108) in view of Falster et al (US 5,919,302) and Kim et al (US 5,942,032) as applied to claims 10 and 14 above, and further in view of Luter et al (5,922,127).

The combination of Holder et al, Falster et al and Kim et al teaches all of the limitations of claim 11, as discussed previously, except a lower heat shield reflector, a lower heat shield outer reflector, a lower heat shield insulation layer

In a crystal pulling apparatus, note entire reference, Luter et al discloses a heat shield **40** comprising a graphite insulation layer **42** sandwiched between an inner **42** and outer reflector **46.** It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Holder et al, Falster et al and Kim et al with Luter et al to distribute defects more evenly throughout the ingot to improve the overall quality of the ingot (col 6, ln 50-67).

Referring to claim 11, the combination of Holder et al, Falster et al, Kim et al and Luter et al teaches inner **42** and outer reflector **46**, a upper heat shield **36**, an intermediate heat shield

40, lower heat shield **42**, an upper heater **24**, where the intermediate heat shield provides support for the upper heat shield, which acts as an insulation shield.

Referring to claim 12-13, the combination of Holder et al, Falster et al, Kim et al and Luter et al teaches a silicon carbide layer covering graphite components in a hot zone, including reflectors, insulation, heaters and heat shields.

(10) Response to Argument

A. The rejection of Claims 1-9 under 35 U.S.C. § 103 over Holder et al.

Holder et al discloses a Czochralski single crystal pulling apparatus comprising graphite components, which are coated with a silicon carbide protective layer (pg 4, ln 26-33). Holder et al also teaches the graphite components contain preferably less than 5 ppm total metals such as iron and as the purity of the graphite increases, the amount of particle generation during high temperature heating decreases (pg 7, ln 10-18). Holder et al also recognizes iron as an undesirable contamination in the silicon carbide coating (pg 3, ln 7-29). The primary difference between Holder et al and the instantly claimed invention is the claimed concentration of iron in the graphite and silicon carbide coating. The Examiner maintains that since Holder clearly teaches iron is an undesirable contamination in the graphite and silicon carbide components, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Holder et al by purifying the graphite and silicon carbide layer to reduce the iron concentration to the instantly claimed range.

Appellants' argument that Holder et al does not teach or suggest reducing the concentration of iron in structural components (pg 5) is noted but is not found to be persuasive.

Holder et al teaches as the purity of the graphite increases, the amount of particle generation during high temperature heating decreases and the graphite components contain **less than** 5 ppm total metals such as iron, molybdenum, copper and nickel, note page 7, lines 10-18. Therefore, Holder et al clearly teaches and suggests reducing in iron in the components will reduce particle generation, which is desirable. Also, Holder et al teaches less than 5 ppm, which suggest lower concentrations of iron.

Appellants' argument that the crystal pulling apparatus of claim 1 has a different utility than a crystal pulling apparatus disclosed by Holder et al is noted but is not found to be persuasive. Appellants allege the apparatus of claim 1 is used to produce a single crystal silicon ingot and wafers sliced therefrom that are substantially free of agglomerated defects and have a low degree of edge iron contamination and the apparatus taught by Holder et al cannot produce ingots that are substantially free of agglomerated defects (pg 7). Appellants' argument is directed to the intended use of the apparatus and does not result in a different utility. Both the claimed invention and the apparatus taught by Holder are directed to graphite components with a silicon carbide coating used for components such as a heat shield in a Czochralski apparatus (pg 19, ln 16 of the appellants' specification and '108 page 6, line 8 to page 7, line 18). The silicon carbide coated graphite components are used for the same purpose; therefore have the same utility.

Appellants' argument that Holder et al does not recognize the desirability of making a growth chamber of structural components having a substantially lower concentration of iron impurity is noted but is not found to be persuasive. Appellants allege that Holder et al teaches an alternative method of reducing iron contaminant by gettering; therefore does not teach or suggest using unconventionally pure forms of graphite and silicon carbide (pg 7-8). Holder et al merely

teaches an alternative solution to a known problem. Holder et al clearly teaches that as the purity of the graphite increases, the amount of particle generation during high temperature heating decreases. Holder et al also teaches the graphite components contain **less than** 5 ppm total metals such as iron, molybdenum, copper and nickel, note page 7, lines 10-18. The range taught by Holder et al overlaps the claimed range and overlapping ranges are held to be obvious. Therefore, Holder et al does teach and suggest the desirability of components with an increased purity and reduced iron contamination.

Appellants' argument that Holder et al does not teach any method for producing a structural component comprising a graphite substrate and a silicon carbide coating having the claimed iron concentration is noted but is not found persuasive. As present on page 6 of the appeal brief and MPEP 2144.04 VII, there are three factors to assess patentability based on the obviousness of purifying an old product.

1. whether the claimed invention has the same utility as closely related materials in the prior art, **and**
2. whether the prior art suggests the claimed form, **or**
3. whether the prior art suggests methods of obtaining the claimed form

The Examiner interprets the three factors to require either 1 and 2 or 1 and 3; therefore the third factor is not required because 1 and 2 are met, as discussed previously. Furthermore, Appellants do not specifically teach in the instant specification the method used to obtain the purified graphite and silicon carbide. Assuming the instant invention is enabled, methods of forming the purified graphite and silicon carbide within the claimed range must be well known in the art because the specification does not teach a novel method for forming the purified graphite and

silicon carbide. Therefore, prior art methods of obtaining the claimed form must be well known in the art and the third factor is met, assuming the instant invention is enabled.

Appellants' arguments contrasting the rejection over Holder et al and the *In Re Stern* situation (pg 9) are noted but are not found to be persuasive. First, Appellants allege that there is no evidence of record of any suggestion in the prior art of the presently claimed structure. The prior art teaches increased purity results in a decreased amount of particle generation and iron is a contaminant (page 7, lines 10-18 and page 3, lines 7-23); therefore the prior art does suggest decreasing the iron concentration in the graphite component and silicon carbide layer. Second, Appellants allege that there is no evidence of record of any suggestion in the prior art of how to make the claimed invention. As discussed previously, only two of the three requirements are required and Holder et al meets the first and second factors; therefore a method of how to obtain the claimed invention is noted required. Also, as discussed previously, Appellants' do not provide any explanation of how to make the claimed structure. Therefore, assuming Appellants invention is enabled, methods of obtaining the claimed structure must have been well known in the art at the time of the invention. Thirdly, Appellants allege an unexpected advantage of producing wafers substantially free of agglomerated defects and have a low degree of edge iron contamination. Holder et al teaches iron, molybdenum, copper and nickel contaminants released from graphite during high temperature processes degrade the resulting crystal (page 2, lines 1-16 and page 3, lines 7-23). Therefore, a person of ordinary skill in the art would expect a reduction in the initial concentration of an iron contaminant in the graphite and silicon carbide component to reduce the amount of iron contaminant in the resulting crystal. Appellants have not shown that the claimed concentration of iron would produce an unexpected result. There is no comparison of

other iron concentration showing that the claimed value is a critical value producing unexpected results. Furthermore, the unexpected result of reduced agglomerated defects is not taught by Appellants to result from the claimed structure. The reduction in agglomerated defects is rather attributed to a combination of the design of the apparatus by increasing the number of structural components, controlling the cooling rate and using iron reduced components, note page 10 of the Appeal Brief.

Appellants' arguments regarding *In Re Cofer* are noted but are not found to be persuasive. Appellants allege that Holder et al does not meet the second and third factors. However, as discussed previously, Holder et al does teach and suggest purifying the graphite component of iron. Also, the third fact is not required to be met, as discussed previously, because the second factor is met and methods of obtaining the claimed concentrations must be well known in the art in order for Appellants invention to be enabled because Appellants do not teach how to obtain the claimed concentrations in the instant specification.

Appellants' argument that there is a lack of motivation to modify Holder et al is noted but is not found to be persuasive. Appellants allege that Holder et al is directed to the problem faced by Applicants of producing a silicon ingot substantially free of agglomerated defects. This is not persuasive because Holder et al recognizes iron is contaminant of graphite and the silicon carbide layer and Holder et al teaches increased purity results in decreased particle generation. Therefore, Holder et al does teach and suggest increasing the purity of silicon carbide coated graphite components to decrease particle generation. It appears Appellants allegedly have discovered an additional advantage to using a purified graphite and silicon carbide component. The fact that applicant has recognized another advantage which would flow naturally from

following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). Furthermore, the advantage alleged by Appellants does not solely result from the use of the purified component, rather results from a combination of controlled cooling, increased number of components and purified components, note page 10 of the Appeal Brief.

In response to appellant's argument that the references fail to show certain features of appellant's invention, it is noted that the features upon which appellant relies (i.e., producing silicon which is substantially free agglomerated defect (pg 10)) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

In response to applicant's argument that the references fail to show certain features of appellant's invention, it is noted that the features upon which appellant relies (i.e., designing the apparatus to have a closed hot zone which contains more structural components than an open hot zone (pg 10)) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

In response to appellant's argument that the references fail to show certain features of appellant's invention, it is noted that the features upon which appellant relies (i.e., decreasing cooling rate of the growing ingot and maintaining the ingot at temperature that keep intrinsic point defects mobile for longer periods of time (pg 10)) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification

are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

B. The rejection of Claims 10 and 14 under 35 U.S.C. § 103 over Holder et al in view of Falster et al and Kim et al.

In regards to appellant's arguments for the patentability of claims 10 and 14 over Holder in view of Falster et al and Kim et al, appellant merely alleges that the prior art does not teach the protective layer such that the concentrations of iron in the substrate an the protective layer are no greater than about $1.5x10^{12}$ atoms/cm^3 and $1.0x10^{12}$ atoms/cm^3. These limitations are obvious in view of the teachings of Holder, as discussed previously, in regards to claims 1-9.

C. The rejection of Claims 11-13 under 35 U.S.C. § 103 over Holder et al in view of Falster et al and Kim et al, and further in view of Luter et al.

In regards to appellant's arguments for the patentability of claims 11-13 over Holder in view of Falster et al, Kim et al and Luter et al, appellant merely alleges that the prior art does not teach the protective layer such that the concentrations of iron in the substrate an the protective layer are no greater than about $1.5x10^{12}$ atoms/cm^3 and $1.0x10^{12}$ atoms/cm^3. These limitations are obvious in view of the teachings of Holder, as discussed previously, in regards to claims 1-9. Luter et al is merely relied upon to teach a lower heat shield reflector, a lower heat shield outer reflector, and a lower heat shield insulation layer.

Conclusion of response to appellant's arguments

In conclusion, the primary argument is whether a person of ordinary skill in the art would have found it obvious to purify the silicon carbide coated graphite component of iron in a Czochralski apparatus taught by Holder et al. The Examiner maintains that Holder et al teaches

iron is a known contaminant of a silicon carbide coated graphite component and increasing the purity of the components is taught to result in decreased particle generation. The mere purity of the component is the basis of patentability by Appellants. However, the mere purity of a component does not render the product unobvious (MPEP 2144.04 VII) because the composition is used for the same components in a Czochralski apparatus and the prior art teaches an increased purity would be desirable.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Matthew Song
June 11, 2007

Conferees:
Nadine Norton

GREGORY MILLS
QUALITY ASSURANCE SPECIALIST

Glenn Caldarola